

EFFECT OF SEED TREATMENT WITH BOTANICALS ON STORABILITY OF SOYBEAN

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Soybean (*Glycine max* (L) Merrill) is an important oilseed crop, but does not store well as it loses viability rapidly under warm and humid storage conditions. One of the major constraints in soybean cultivation is the non-availability of high vigour seeds at the time of sowing. The use of chemicals and their residual toxicity adversely affects non-target animals, including human beings as well as seed quality. However, the use of chemicals is still popular. Hence, a safe and feasible approach is the treatment of seeds with botanicals which are safe, economical, eco-friendly and non-harmful to seed, animals and human beings.

The present investigation was carried out to study the effect of seed treatment with botanicals on the storability of soybean using the variety JS-335 together with deltamethrin under ambient storage conditions at the Seed Research Laboratory, Nation Seed Project, UAS, Dharwad. All the seed quality parameters showed significant differences due to seed treatments with botanicals. The results showed that seed treatment with detrimethrin @ 40 mg/kg of seed resulted in significantly higher germination (82.27%), root length (16.99 cm), shoot length (15.88 cm), seedling dry weight (94.43 mg), seedling vigour index (2703), field emergence (74.22%) and lowest electrical conductivity of seed leachate (1.168 dSm^{-1}) and moisture content of seed (9.07%) at the end of a seven month storage period. This treatment was found on par with sweet flag rhizome powder @ 10 g / kg treated seeds (81.44%, 16.78cm, 15.65 cm, 94.34 mg, 2641, 73.33%, 1.198 dSm^{-1} and 9.10%, respectively) compared to the control (73.22%, 14.73 cm, 14.10 cm, 87.20 mg, 2146, 67.44%, 1.3353 dSm^{-1} and 9.69%, respectively).

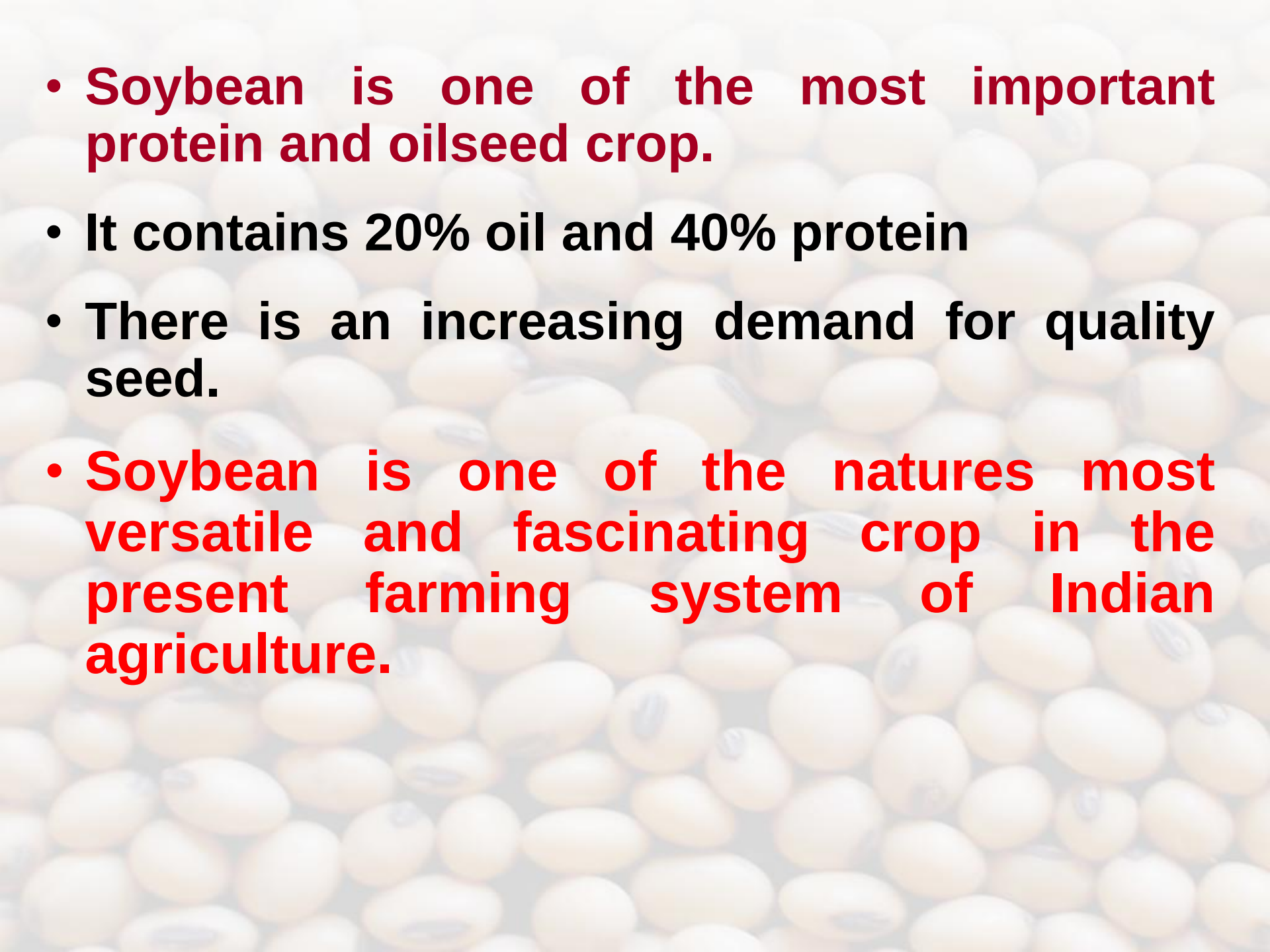
Effect of seed treatment with botanicals on storability of soybean

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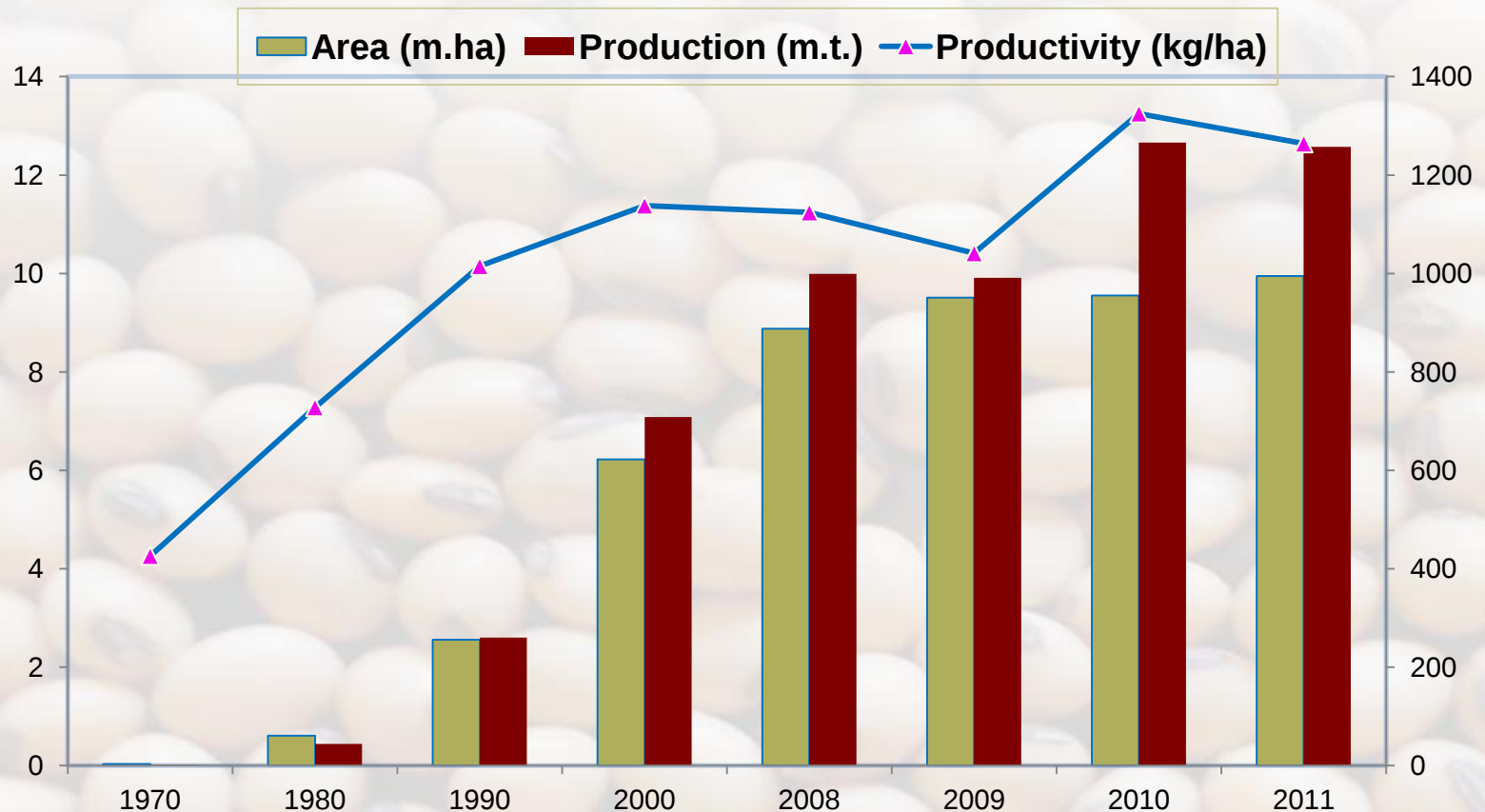
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- The background of the slide is a close-up, slightly blurred image of numerous light-colored soybean seeds. Each seed is oval-shaped with a distinct dark, curved line (the hilum) running along its length. The seeds are densely packed, creating a textured, organic pattern across the entire slide.
- Soybean is one of the most important protein and oilseed crop.
 - It contains 20% oil and 40% protein
 - There is an increasing demand for quality seed.
 - Soybean is one of the nature's most versatile and fascinating crop in the present farming system of Indian agriculture.

- In storage, viability and vigour of the seeds is regulated by many physico-chemical factors.
- It loses viability rapidly under warm and humid storage conditions, is listed as poor storer.

Hence, storage of seed till next planting time assumes prime importance for successful seed production programme.

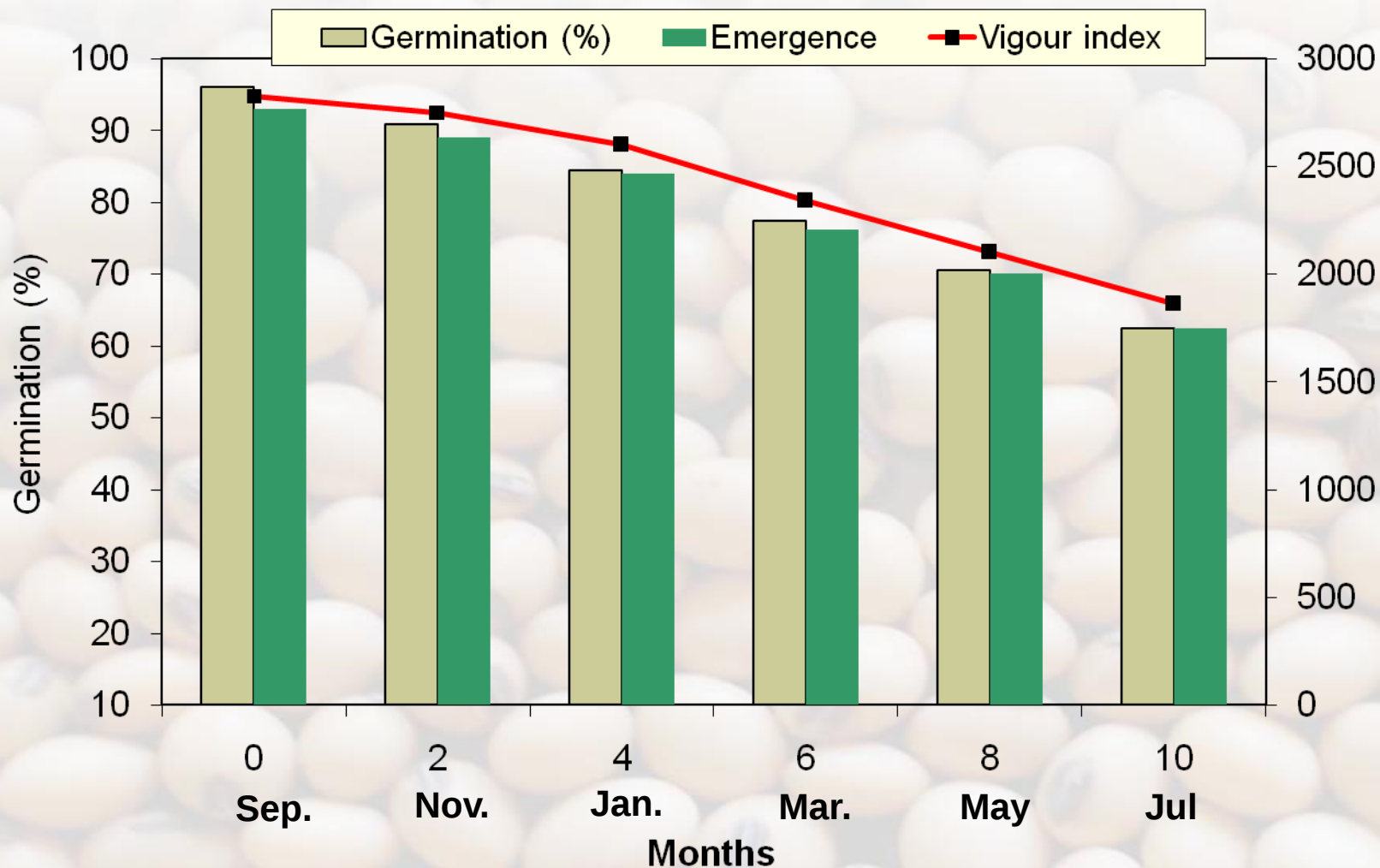


Area, production and productivity of soybean crop

- Introduced in India in 1980
- The area is increasing very fast
- In a span of short period soybean become No. 1 oil seed crop of India by replacing traditional groundnut

Problems in quality seeds

- The seed rate per unit area is very high (75 kg ha⁻¹).
- Seed viability and vigour are the serious problems in soybean. Viability is less than one year
- Seed viability is affected by several factors. All pre and post harvest operations till sowing
- Soybean seeds are very sensitive, loose viability very fast due to its fragile seed coat.



*** After 6-8 months, the germination, vigour and emergence is reduced sharply**

Seed quality problems in soybean

- Maintenance of seed viability and vigour till sowing is very critical (9-10 months).
- The seeds produced from monsoon seasons has to stored till next monsoon for sowing
- Alternate strategy of off season for seed production is not feasible due to low productivity.
- Poor germination and low seed viability are among the serious problems limiting production of soybean
- Use of low physiological quality seeds is a common practice leading to inadequate plant population is the main reason for low yield per unit area compare to China and USA.
- Yield per unit area of the crop is low in India.
- Rapid germination and emergence is an important factor for successful establishment.

Why there is need for application of organics?

- Chemical fertilizers are not available at affordable prices to the farmers
- **Chemical fertilizers are playing a crucial role to meet the nutrient requirement of the crop, persistent nutrient depletion is posing a greater threat to sustainable agriculture.**
- The descriptive use of chemicals and their residual toxicity adversely affects the non-targeted animals including human being besides affecting the seed quality
- **Many of the synthetic chemicals look effective but they are not readily degradable physically or biologically which yield more toxic residues.**
- Hence, safe and feasible approach is the treatment of seeds with botanicals which are safe, economical, eco friendly, cheap, easily available and non harmful to seed, animals and human beings.

Treatments

Factor I: Soybean seed obtained from the following treatment of field experiment.

S_1 = RDF + FYM

S_2 = 1st best treatment in field experiment [VC (100% N) + RP]

S_3 = 2nd best treatment in field experiment [FYM (50%) + VC (50%) + RP]

Factor II: Organics / botanicals used for seed treatment

T_1 = Sweet flag rhizome powder @ 10 g kg⁻¹ of seed

T_2 = Neem leaf powder @ 20 g kg⁻¹ of seed

T_3 = Neem oil @ 10 ml kg⁻¹ of seed

T_4 = Castor oil @ 10 ml kg⁻¹ of seed

T_5 = Turmeric powder @ 10 g kg⁻¹ of Seed

T_6 = Deltamethrin @ 40 mg kg⁻¹ of seed

T_7 = Control (untreated).

Effect of seed source and seed treatments with organics on germination (%) in soybean

	Treatments	Storage period (months)				
		Initial	2	4	6	8
	Seed source					
S₁	RDF + FYM	96.27	93.81	89.95	84.14	78.76
S₂	VC (100%) + RP	95.92	93.48	89.48	83.81	77.52
S₃	FYM (50%) + VC (50%) + RP	95.68	93.33	89.19	83.71	76.33
	S.Em	0.25	0.21	0.25	0.27	0.34
	CD at 5%	NS	NS	NS	NS	NS
	Botanicals					
T₁	Sweet flag rhizome powder @ 10 g/kg	96.50	94.11	91.33	85.72	81.44
T₂	Neem leaf powder @ 20 g/kg	95.56	93.44	88.89	83.33	75.33
T₃	Neem oil @ 10 ml/kg	96.04	93.67	89.56	84.35	77.67
T₄	Castor oil @ 10 ml/kg	96.26	94.00	90.00	84.67	78.67
T₅	Turmeric powder @ 10 g/kg	95.31	92.22	87.89	83.22	74.22
T₆	Deltamethrin @ 40 mg per kg	96.71	94.67	93.11	86.44	82.22
T₇	Control	95.43	92.67	86.00	79.47	73.22
	Mean	95.96	93.54	89.54	83.89	77.54
	S.Em	0.38	0.32	0.38	0.42	1.01
	CD at 5%	NS	0.91	1.08	1.19	2.87

NS : Non significant

RDF : Recommended dose of fertilizer

FYM : Farm yard manure

VC : Vermicompost

S₁ : RDF (40 : 80 : 25 kg NPK ha⁻¹) + FYM (5 t ha⁻¹)

S₂ : VC (4 t ha⁻¹) + RP (176 kg ha⁻¹)

S₃ : FYM (4.00 t ha⁻¹) + VC (2 t ha⁻¹) + RP (200 kg ha⁻¹)

RP : Rock phosphate

Effect of seed source and seed treatments with organics on root length (cm) in soybean

	Treatments	Storage period (months)				
		Initial	2	4	6	8
	Seed source					
S₁	RDF + FYM	19.60	18.97	18.52	16.63	16.24
S₂	VC (100%) + RP	19.54	18.95	18.49	16.56	16.19
S₃	FYM (50%) + VC (50%) + RP	19.52	18.93	18.47	16.53	16.12
	S.Em	0.02	0.04	0.05	0.13	0.14
	CD at 5%	NS	NS	NS	NS	NS
	Botanicals					
T₁	Sweet flag rhizome powder @ 10 g/kg	19.56	19.16	18.75	16.99	16.78
T₂	Neem leaf powder @ 20 g/kg	19.54	18.83	18.48	16.48	16.23
T₃	Neem oil @ 10 ml/kg	19.55	18.89	18.58	16.67	16.39
T₄	Castor oil @ 10 ml/kg	19.56	19.01	18.65	16.78	16.46
T₅	Turmeric powder @ 10 g/kg	19.54	18.78	18.29	16.37	15.71
T₆	Deltamethrin @ 40 mg per kg	19.59	19.21	18.82	17.45	16.99
T₇	Control	19.54	18.68	17.77	15.27	14.73
	Mean	19.56	18.95	18.49	16.57	16.18
	S.Em	0.02	0.07	0.07	0.20	0.22
	CD at 5%	NS	0.21	0.26	0.58	0.62

NS : Non significant

RDF : Recommended dose of fertilizer

FYM : Farm yard manure

VC : Vermicompost

S₁ : RDF (40 : 80 : 25 kg NPK ha⁻¹) + FYM (5 t ha⁻¹)

S₂ : VC (4 t ha⁻¹) + RP (176 kg ha⁻¹)

S₃ : FYM (4.00 t ha⁻¹) + VC (2 t ha⁻¹) + RP (200 kg ha⁻¹)

RP : Rock phosphate

Effect of seed source and seed treatments with organics on shoot length (cm) in soybean

	Treatments	Storage period (months)				
		Initial	2	4	6	8
	Seed source					
S₁	RDF + FYM	18.66	17.94	17.28	15.59	15.22
S₂	VC (100%) + RP	18.64	17.91	17.25	15.64	15.20
S₃	FYM (50%) + VC (50%) + RP	18.61	17.89	17.21	15.63	15.17
	S.Em	0.04	0.02	0.08	0.10	0.10
	CD at 5%	NS	NS	NS	NS	NS
	Botanicals					
T₁	Sweet flag rhizome powder @ 10 g/kg	18.66	18.06	17.53	16.00	15.65
T₂	Neem leaf powder @ 20 g/kg	18.62	17.81	17.19	15.50	15.24
T₃	Neem oil @ 10 ml/kg	18.63	17.95	17.35	15.66	15.39
T₄	Castor oil @ 10 ml/kg	18.64	18.00	17.41	15.79	15.37
T₅	Turmeric powder @ 10 g/kg	18.61	17.72	16.89	15.36	14.78
T₆	Deltamethrin @ 40 mg per kg	18.68	18.26	17.78	16.33	15.88
T₇	Control	18.59	17.61	16.58	14.94	14.10
	Mean	18.64	17.91	17.25	15.66	15.19
	S.Em	0.07	0.08	0.13	0.16	0.15
	CD at 5%	NS	0.22	0.37	0.54	0.42

NS : Non significant

RDF : Recommended dose of fertilizer

FYM : Farm yard manure

VC : Vermicompost

S₁ : RDF (40 : 80 : 25 kg NPK ha⁻¹) + FYM (5 t ha⁻¹)

S₂ : VC (4 t ha⁻¹) + RP (176 kg ha⁻¹)

S₃ : FYM (4.00 t ha⁻¹) + VC (2 t ha⁻¹) + RP (200 kg ha⁻¹)

RP : Rock phosphate

Effect of seed source and seed treatments with organics on seedling vigour index in soybean

	Treatments	Storage period (months)				
		Initial	2	4	6	8
	Seed source					
S ₁	RDF + FYM	3682	3461	3320	2726	2492
S ₂	VC (100%) + RP	3665	2447	3189	2703	2433
S ₃	FYM (50%) + VC (50%) + RP	3654	3439	3198	2683	2411
	S.Em	31	29	34	29	25
	CD at 5%	NS	NS	NS	NS	NS
	Botanicals					
T ₁	Sweet flag rhizome powder @ 10 g/kg	3697	3503	3313	2835	2641
T ₂	Neem leaf powder @ 20 g/kg	3647	3420	3167	2658	2378
T ₃	Neem oil @ 10 ml/kg	3668	3465	3218	2719	2467
T ₄	Castor oil @ 10 ml/kg	3685	3479	3246	2759	2504
T ₅	Turmeric powder @ 10 g/kg	3638	3395	3101	2627	2280
T ₆	Deltamethrin @ 40 mg per kg	3702	3547	333	2931	2703
T ₇	Control	3631	3332	2954	2400	2146
	Mean	3667	3449	3198	2704	2446
	S.Em	46	44	51	44	39
	CD at 5%	NS	126	146	127	111

NS : Non significant

RDF : Recommended dose of fertilizer

FYM : Farm yard manure

VC : Vermicompost

S₁ : RDF (40 : 80 : 25 kg NPK ha⁻¹) + FYM (5 t ha⁻¹)

S₂ : VC (4 t ha⁻¹) + RP (176 kg ha⁻¹)

S₃ : FYM (4.00 t ha⁻¹) + VC (2 t ha⁻¹) + RP (200 kg ha⁻¹)

RP : Rock phosphate

Effect of seed source and seed treatments with organics on field emergence (%) in soybean

	Treatments	Storage period (months)				
		0	2	4	6	8
	Seed source					
S ₁	RDF + FYM	92.91	88.14	83.76	77.00	71.53
S ₂	VC (100%) + RP	92.40	87.81	83.05	76.91	71.38
S ₃	FYM (50%) + VC (50%) + RP	91.77	86.86	82.67	76.00	70.48
	S.Em	0.33	0.40	0.32	0.41	0.61
	CD at 5%	NS	NS	NS	NS	NS
	Botanicals					
T ₁	Sweet flag rhizome powder @ 10 g/kg	92.49	88.89	84.67	78.67	73.33
T ₂	Neem leaf powder @ 20 g/kg	92.34	87.22	82.57	75.67	69.89
T ₃	Neem oil @ 10 ml/kg	92.37	87.44	83.22	77.30	70.89
T ₄	Castor oil @ 10 ml/kg	92.43	88.67	83.89	77.33	72.44
T ₅	Turmeric powder @ 10 g/kg	92.23	86.11	81.44	75.89	69.67
T ₆	Deltamethrin @ 40 mg per kg	92.61	90.56	86.56	79.33	74.22
T ₇	Control	92.07	84.33	79.78	72.22	67.44
	Mean	92.36	87.60	83.16	76.64	71.13
	S.Em	0.33	0.61	0.48	0.63	0.93
	CD at 5%	NS	1.73	1.38	1.81	2.660

NS : Non significant

RDF : Recommended dose of fertilizer

FYM : Farm yard manure

VC : Vermicompost

S₁ : RDF (40 : 80 : 25 kg NPK ha⁻¹) + FYM (5 t ha⁻¹)

S₂ : VC (4 t ha⁻¹) + RP (176 kg ha⁻¹)

S₃ : FYM (4.00 t ha⁻¹) + VC (2 t ha⁻¹) + RP (200 kg ha⁻¹)

RP : Rock phosphate

Effect of seed source and seed treatments with organics on electrical conductivity (dSm⁻¹) in soybean

	Treatments	Storage period (months)				
		Initial	2	4	6	8
	Seed source					
S ₁	RDF + FYM	0.334	0.452	0.696	1.107	1.238
S ₂	VC (100%) + RP	0.336	0.453	0.698	1.113	1.243
S ₃	FYM (50%) + VC (50%) + RP	0.339	0.456	0.705	1.020	1.256
	S.Em	0.001	0.005	0.006	0.008	0.01
	CD at 5%	NS	NS	NS	NS	NS
	Botanicals					
T ₁	Sweet flag rhizome powder @ 10 g/kg	0.334	0.429	0.667	1.092	1.198
T ₂	Neem leaf powder @ 20 g/kg	0.338	0.458	0.704	1.126	1.250
T ₃	Neem oil @ 10 ml/kg	0.337	0.443	0.690	1.115	1.231
T ₄	Castor oil @ 10 ml/kg	0.335	0.436	0.672	1.098	1.223
T ₅	Turmeric powder @ 10 g/kg	0.339	0.483	0.710	1.144	1.269
T ₆	Deltamethrin @ 40 mg per kg	0.334	0.425	0.661	1.057	1.168
T ₇	Control	0.340	0.497	0.793	1.172	1.353
	Mean	0.337	0.453	0.700	1.111	1.246
	S.Em	0.002	0.007	0.009	0.014	0.015
	CD at 5%	NS	0.021	0.026	0.040	0.040

NS : Non significant

RDF : Recommended dose of fertilizer

FYM : Farm yard manure

VC : Vermicompost

S₁ : RDF (40 : 80 : 25 kg NPK ha⁻¹) + FYM (5 t ha⁻¹)

S₂ : VC (4 t ha⁻¹) + RP (176 kg ha⁻¹)

S₃ : FYM (4.00 t ha⁻¹) + VC (2 t ha⁻¹) + RP (200 kg ha⁻¹)

RP : Rock phosphate

Conclusion

- Seed quality parameters did not differ significantly due to the different seed source. However, seed obtained from RDF + FYM recorded higher germination (78.76%), root length (16.24 cm), shoot length (15.22 cm), seedling dry weight (90.87 mg), vigour index (2492) and field emergence (71.53%) compared to other seed sources. The lower electrical conductivity and moisture content (1.238 dSm^{-1} and 9.32%, respectively) were recorded in S_1 (RDF + FYM).
- The interaction effect between seed source and seed treatments showed non-significant variation at all the months and storage. However, higher germination (83.00%), root length (17.03 cm), shoot length (15.93 cm), seedling dry weight (93.45 mg), vigour index (2736) were recorded in S_1T_6 {(RDF + FYM) + (Deltamethrin @ 40 mg per kg)} whereas lowest (73.33%, 14.56 cm, 14.10 cm, 87.17 mg and 2102, respectively) in S_3T_7 {(FYM (50%) + VC (50%) + RP) + (Control)}.

The background of the image is a dense, repeating pattern of white beans with black eyes, commonly known as navy beans. The beans are arranged in a somewhat regular grid-like fashion, filling the entire frame. They have a smooth, slightly glossy texture.

Thank You